

## CLAIMS:

1. A search method comprising the steps of:
  - a) partitioning a search region into n segments, where n is greater than 0;
  - b) searching each segment with a first predetermined algorithm;
  - c) for each segment, generating from said searching information indicating whether or not any indicator bit set to a predetermined state has been detected and the location of the indicator bit; and
  - d) using the information provided in step c) to select a winning location.
2. The search method of claim 1 further including the step of performing a predetermined action on an entity associated with the winning location.
3. The search method of claim 1 or claim 2 further including the step of determining with a second algorithm a location in the segment from which searching starts.
4. The search method of claim 3 further including the step of providing a pointer to identify the location whereat searching starts; and  
stepping the pointer sequentially to access a plurality of locations within the region; and  
testing indicator bit at each location to see if it is set in the predetermined state; and

7 generating a control signal for the first location encountered with the  
8 indicator bit set to the predetermined state.

1 5. The method of claim 1 wherein the search region includes a plurality of  
2 contiguous locations to which information can be written or deleted and an  
3 indicator whose setting indicates information or no information at a selected  
4 location.

1 6. The method of claim 5 wherein the information includes an identification number  
2 for at least one flow queue.

1 7. The method of claim 1 wherein the searches are executed simultaneously.

1 8. The method of claim 7 wherein for step b) first it is assumed no current pointer  
2 (CP) is in a segment being searched wherein searching begins at a first location  
3 of the segment and ends at a last location of said segment; and

4 second it is assumed a current pointer (CP) is in the segment being  
5 searched wherein searching begins at the CP location in said segment being  
6 searched ending at the last location of the segment and searching begins at the  
7 first location in the segment ending at the location preceding the CP.

1 9. A method to determine the next packet to forward from one of a plurality of flow  
2 queues comprising:

3 (a) providing in a memory a search region including a plurality of contiguous  
4 locations to which information can be written/deleted and an indicator  
5 whose state indicates the present or absent of information at a selected  
6 location;

7 (b) partitioning said search region into n segments, wherein n is greater than  
8 0;

9 (c) determining a first location from which searching begins for each  
10 segment;

11 (d) searching each segment in accordance with a first predetermined  
12 algorithm;

13 (e) generating from each segment information indicating whether or not any  
14 indicator set to a predetermined state has been detected in said segment  
15 and location of detection;

16 (f) determining the segment in which a valid indicator is most likely located;  
17 and

18 (g) examining the information in (e) and (f) with a second predetermined  
19 algorithm to select a winner indicator and location.

1 10. h) The method in claim 9 further including using the information in step g) to  
2 move a packet from a queue associated with the location in step g).

1 11. An apparatus including:

2 n traffic flow Queues, wherein n is greater than 0;

3 a processing complex including at least one processor that enqueues  
4 packets on selected ones of the traffic flow queues;

5 a memory with a search zone having a plurality of search locations with  
6 each search location including at least one indicator;

7 p segment search engines, p is greater than 1, and each of said p  
8 segment search engine includes m inputs wherein each one of the m inputs  
9 operatively coupled to an indicator within a group of indicators; and

10 a top search engine responsive to signals provided by the p segment  
11 search engines to generate a control signal identifying a location within said  
12 search zone.

13 12. The apparatus of claim 11 further including

14 a first scheduler function that monitors the traffic flow queues and periodically  
15 attaches to a location in said search zone a characteristics of a traffic flow queue  
16 if a packet is placed in said traffic flow queue; and

17 a second scheduler function responsive to the control signal to transmit a packet  
18 from a selected Flow Queue.

19 13. The apparatus of claim 12 further including a plurality of target port Queues

2 wherein one of said target port queues received the transmitted packet.

1 14. The apparatus of Claim 12 wherein the characteristics includes the flow queue  
2 identification number.

1 15. A device comprising:

2 p segment search engines, p greater than 1 and each segment search  
3 engine having m inputs, m greater than 1, representing portions of a search  
4 zone;

5 at least one storage location that stores information outputted from each  
6 of the p segment search engines; and

7 a top search engine responsive to stored information to select and identify  
8 one of the locations in said search zone.

9 16. The method of claim 1 wherein each segment includes m entries, wherein m is  
10 an even power of 2.

1 17. The method of claim 1 or 16 wherein step d) further includes the step of  
2 correlating outputs from each segment search with a top search algorithm to  
3 select the winning location.

1 18. A method for controlling the flow of information packets within a communications

2 device including the steps of:

- 3 (a) partitioning a calendar into n segments, wherein n is greater than 0;
- 4 (b) searching each segment with a segment search algorithm to identify at
- 5 least one location with an indicator set to a first state;
- 6 (c) examining with a top search algorithm locations detected in step (b); and
- 7 (d) selecting one of the locations as a winning location.

1 19. The method of Claim 18 further including the steps of determining a final winning  
2 location by concatenating an identification number for a winner segment  
3 containing the winning location to a value for the winning location within said  
4 winner segment; and

5 forwarding a packet from a flow queue having a same identification  
6 number matching an identification number stored at the final winning location.

7 20. A program product including:

2 a media on which a computer program is recorded, said computer  
3 program having

- 4 (a) a set of instructions that partition a calendar into n segments, n is greater
- 5 than 0;
- 6 (b) a set of instructions that search each segment with a segment search
- 7 algorithm to identify at least one location with an indicator set to a first
- 8 state;

- 9 (c) a set of instructions that examine with a top search algorithm locations  
10 identified in step (b); and  
11 (d) a set of instructions that selects one of the locations as a winning location.

1 21. The program product of Claim 20 further including

- 2 (e) a set of instructions that determines a final winning location by  
3 concatenating an identification number for a winner segment containing  
4 the winning location to a value for the winning location within said winner  
5 segment; and  
6 (f) a set of instructions to generate and issue a signal that causes a device to  
7 forward a packet from a flow queue having an identification number  
8 matching an identification number stored at the final winning location.  
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